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CITY OF BOSTON

Report No. 9

WATER DIVISION
of the
PUBLIC WORKS DEPARTMENT

December 7, 1948

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GRIFFENHAGEN & ASSOCIATES
CONSULTANTS IN PUBLIC ADMINISTRATION AND FINANCE

CITY OF BOSTON

Report No. 9

WATER DIVISION
of the
PUBLIC WORKS DEPARTMENT

December 7, 1948

Prepared by
Griffenhagen & Associates
Consultants in Public Administration and Finance

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Boston Finance Commission
Sept. 14, 1954

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G R I F F E N H A G E N & A S S O C I A T E S

(Established 1911)

Consultants in Public Administration and Finance

Boston 8
December 7, 1948

The Honorable,
The Chairman and the Members
of the
Finance Commission of the City of Boston
24 School Street
Boston 8, Massachusetts

Dear Sirs:

Presented herewith is our Report No. 9 covering the Water Division of the Public Works Department.

Yours faithfully,

Griffenhagen & Associates

Griffenhagen & Associates

SUMMARY OF FINDINGS

The water division is one of five principal divisions of the public works department. Annually the division expends about $1,600,000 and as of August 1948 there were 436 employes assigned to work on water division activities.

Since 1895 the City of Boston has depended upon the Metropolitan Water Board for its supply of water. The water division is concerned only with the distribution of water and the billing of consumers for the use of water.

The organization of the division includes an engineering section; a central business office where billing is done, accounts are kept, and meter reading is supervised; a meter repair shop; a machine shop where hydrants and gates are manufactured; and a maintenance organization consisting of four districts for maintaining the distribution system.

The water division seems to be giving the citizens of Boston a satisfactory water service. Probably the greatest immediate attention should be given to reducing the possible loss of revenue due to inadequate meter testing and repair facilities. Due to the fact that about 16,000 meters are "stopped" (not registering) but have not been replaced, approximately one water billing in six is based on an estimated consumption. The lack of a policy of periodic testing of meters and failure to test meters on low flows are factors that also contribute to the loss of revenue. It would appear that as much as 10 percent or $500,000 a year of revenues is being lost due to the lack of a sound metering policy.

Only about 68 percent of the water purchased from the Metropolitan Water Board is accounted for in meter registrations and estimates for billings. Normal losses through leakage and miscellaneous uses such as for sewer flushing and fire fighting usually amount to about 15 percent and it is, therefore, desirable to keep unaccounted-for water to this percentage. The difference between 68 percent and 85 percent is probably represented by lack of registration of water uses and in excessive water leakage. Insufficient attention is being given to both of these possible losses. A reduction in water leakage is also important because the City pays for the water on a quantity delivered basis.

The clerical and bookkeeping activities are being handled competently. However, because some of the office duties are divided between two locations, the efficiency of the work is reduced.

Engineering is handled competently but the scope of responsibility of the engineering staff is too limited.

The organization for district maintenance work is weak. There is too much specialization in the Albany street district.

The receipts of the water division exceed expenditures by about $1,500,000 annually. These excess funds are turned over to the City to meet general City debt.

The adoption of the recommendations contained in this report should make possible the same work accomplishment with 70 fewer employes and annual payroll savings of $172,400. However, some of these savings should be used to strengthen the engineering section and the meter shop and to establish a program to reduce underground leakage of water.

SUMMARY OF RECOMMENDATIONS

The recommendations expressed or implied in Report No. 9 on the water division of the public works department are summarized as follows:

1 Transfer the general supervision over the meter shop from the chief clerk to the division engineer. (Sections 3,7)

2 Place all of the operations of the Albany street district under one supervisor or foreman. (Section 3)

3 Organize all engineering activities on a city-wide basis. (Section 3)

4 Assign to the head of the engineering division the duties of assistant division engineer. (Section 3)

5 Contract for the inspection of castings and eliminate the two positions currently assigned to this work. (Section 4)

6 Establish a program for the control of underground leakage of water and the reduction of unaccounted-for water. (Section 4)

7 Assign to the engineering section more overall management responsibilities of the water division. (Section 4)

8 Abandon the keeping of records of encumbrances of budget accounts and rely on the official accounts kept in the City auditor's office. (Section 5)

9 Revise the organization of the central business office to reduce the number of employes reporting to the chief clerk from 13 to 7. (Section 6b)

10 Reduce the staff of "miscellaneous clerks" by six positions through better supervision, better scheduling of work, and higher productivity of employes. (Section 6b)

11 Establish a definite procedure for making abatements to water bills; removing as much of the discretionary authority of employes as practicable. (Section 6c)

12 Improve the efficiency of the workers in the meter reading section and reduce the staff by eight employes, - four regular meter readers, two pickup meter readers, and two laborers. (Section 6d)

13 To simplify mailing operations, change the addressograph plates so that the addresses will always register with the envelope window and to reduce clerical needs by one clerk position, purchase a machine that will fold the bills and place them in envelopes in a single operation. (Section 6e)

14 Place the mail clerk, the addressograph clerk, and the miscellaneous clerks under the supervision of the billing section supervising clerk. (Section 6e)

15 To determine staff needs, keep records of the work accomplishments of constables showing the number of addresses corrected and the number of delinquent accounts processed. (Section 6f)

16 Set up a definite policy of bringing all water meters in for a complete servicing at least once every ten years. (Section 7)

17 To improve registration on low flows, test water meters on the 1/16" stream. (Section 7)

18 Institute a program for changing water meter settings, where needed, so that meters can be changed, serviced, and read more easily. (Section 7)

19 Replace as rapidly as possible the large number of "stopped" (not registering) meters. (Estimated to be 16,000 or about 16% of the total number).

20 Purchase new meter shop testing and repair equipment and place the shop on a modern and efficient basis.

21 Assign more responsibility to the districts for servicing water meters, but not including any shop repair work. (Section 7)

22 Establish a policy of sealing all meters and meter connections. (Section 7)

23 Purchase an adequate supply of new meters, stock sufficient repair parts for servicing meters, and standardize on two or three makes of meters. (Section 7)

24 Strengthen supervisory authority over meter shop employes and recruit and train a staff of competent mechanics. (Section 7)

25 So as to compare the costs with costs of similar equipment available on the open market and to establish administrative controls over the production of individual employes, set up a set of simple records to determine the costs of producing hydrants and gates in the machine shop. (Section 8)

26 Provide that the superintendent give more general supervision to all district operations and be relieved of some of the detailed supervision that he now is required to give to Albany district operations. (Section 9a)

27 Transfer the payroll work and the clerks doing such work in the office of the superintendent to the office of the executive secretary. (Section 9b)

28 Discontinue the practice of keeping duplicate records of material requisitions and receiving reports in the form of registers. (Section 9b)

29 Discontinue the practice of using specialized crews in the Albany street district and assign all work on each job to one supervisor who would see the job through from start to finish. (Section 10a, 10b, 10c, 10d)

30 Consolidate the day shift emergency crews with regular maintenance forces in the Albany street district. (Section 10a)

31 For normal work, reduce the size of off-and-on crews to one man. (Section 10a)

32 To reduce underground leakage, establish a program for plugging "dead" services at the main. (Section 10b)

33 Assign the so-called "regulating work" being done by the hydrants and gates unit to the paving division. (Section 10c)

34 Discontinue the practice of icing the 37 water fountains. (Section 10c)

35 Limit Saturday work to emergencies and reduce the crews accordingly. (Section 10f)

36 Assign the emergency crew foreman to the 4 p.m. to 12 m. shift. (Section 10f)

37 Reduce the size of each of the Albany street emergency crews from four to two employes. (Section 10a)

38 Discontinue the district office telephone complaint service and route all complaints direct to the Albany street district emergency desk. (Section 10a)

39 Assign to the engineering unit responsibility for approving the design of all major items made by the shops including barricades. (Section 10a)

40 Inspect and service all hydrants at least once each year. (Section 11,12)

41 Establish a definite procedure for determining the amount of excavation made by the contractor, and provide for outside limits as to width of trench and method of taking measurements. (Section 14a)

42 Establish a policy that applies city-wide on the acceptance of deposits for excavation work on City property adjacent to private foundations. (Section 14b)

43 Establish a definite policy for making backfills and enforce the policy in each district. (Section 14c)

44 Centralize the responsibility for making temporary pavement repairs or assign this work to the paving division. (Section 14c)

45 Establish a policy defining the responsibility for servicing large gates. (Section 14d)

46 Establish definite routes and schedules for hydrant service and inspection work. (Section 14d)

47 Discontinue the practice of assigning chauffeurs to supervisors and eliminate the seven positions so classified. (Section 14e)

48 Develop a manual of standard practices for all operations of the water division. (Section 14f)

49 Develop a manual showing the duties of each supervisor and each organization unit. (Section 14f)

50 Revise the classification of the large number of employes whose duties are not consistent with their classifications. (Section 15)

51 To reduce lost time of employes, give further study to methods of distributing pay to employes. (Section 15)

52 Set up more rigid controls over adherence to the hours of the work day, including such controls as the installation of time clocks for shop employes. (Section 15)

WATER DIVISION
of the
PUBLIC WORKS DEPARTMENT

1. Introduction

The supply of water to Boston residents has been the concern of various bodies, private and public, for many years. In 1652, a private company was chartered by the General Court of Massachusetts Bay Colony under the title of "Water Works Company." In 1795, an Aqueduct Corporation was formed to carry water from Roxbury into any street of the Town of Boston. The company brought water from Jamaica Pond, now a part of Boston, through four main lines of pitch pine log pipes and, by 1845, was supplying about 1500 houses in Boston.

In 1834, the Mayor of Boston recommended bringing a "copious and steady supply of pure and soft water into the City of Boston," and a survey made by Loammi Baldwin recommended bringing water from Framingham or Natick. Lake Cochituate became a water supply in 1848 but this supply also proved to be inadequate and, in 1878, an extension of the supply system was made to include the water shed of the Sudbury River. By 1893, the water supply was again inadequate, not only for Boston, but also for nearby cities. After an investigation by the State Board of Health, the State Legislature in 1895 passed an Act creating the Metropolitan Water Board and that Board and its successors have provided water for Boston and vicinity up to the present day.

The Metropolitan Water Board furnishes water of suitable quality and of sufficient quantity and pressure to Boston through various connections located near the outer limits of the City. The water division of the department of public works distributes the water from these supply points to all parts of Boston through a distribution system including mains, services, and meters. This report deals with the division which is responsible for the construction and maintenance of the distribution system, the reading of meters, and the keeping of accounts.

On August 31, 1948 there were 436 City employes working for the water division whose annual salaries totaled $1,126,158.

2. Functions and Activities

The water division is responsible for all water utility operations in connection with distributing water to the residents of Boston except for the collection of water bills which is handled by the collector's office. Specifically, the division constructs and maintains mains, hydrants, valves, and services; reads and maintains meters, bills customers for water used; and keeps accounts. The division maintains a machine shop where hydrants and valves are manufactured, a plumbing shop for service installation and repair work, and a meter shop for repairing and testing of water meters. The division also does its own engineering work.

Although most of the work of the division is done by day labor forces, approximately $140,000 is spent annually for contract work including general excavating, laying mains, and setting hydrants.

The inspection and control of cross-connections between the City water supply and private sources of water supply are reported to be responsibilities of the health department as is also the periodic testing of water for purity.

One of the activities of the division is the maintenance of a 24 hour service 7 days a week to take care of emergencies and customer complaints.

3. Organization and Staff

As of August 31, 1948 the staff and organization of the water division was approximately as follows:

Organization Unit	Number of Employes	Annual Payroll Cost
Office of the division engineer	11	$ 38,000
Office of the executive secretary	6	17,200
Central business office		
Chief clerk's office and misc.	20	47,570
Executive clerk's office	6	16,600
Meter reading section	38	100,196
Billing section	22	53,300
Delinquent accounts section	12	29,100
Cashier's section	2	5,800
Meter repair shop	24	62,238
District maintenance		
Office	19	51,926
Albany repair gangs	20	51,478
Albany "outside employes"	35	87,560
Plumbing shop	23	60,448
Hydrants and gates	19	48,084
Emergency crews	45	113,552
Albany street yards	20	51,500
Machine shop	31	81,062
Dorchester district	21	53,922
W. Roxbury district	25	64,568
Brighton district	16	39,314
Charlestown sub-yard	8	18,980
Garage (charge back)	13	33,760 a/
Totals	436	$1,126,158

The organization structure of the division is reasonably satisfactory but can be improved as described elsewhere in the report and in the following paragraphs.

The meter repair shop is under the general supervision of the chief clerk who heads accounting and billing activities. Because of the importance of this shop and its effect on the revenues of the division, it is recommended that the head of the meter shop report direct to the division engineer. The lack of attention that has been given to meter shop activities during recent years is another important reason why it should be given special supervision by the division engineer.

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a/ These employes are assigned full time to the equipment service unit under the paving division and are considered in a separate report in this series.

The supervision given district yard activities is not as effective as it should be. The superintendent is chiefly concerned with Albany street district operations and gives little attention to the work of the other districts. This situation is undoubtably a result of the lack of any head over the Albany street district. The work in this district is organized according to specialized services, the heads of which report direct to the superintendent. One foreman should be in charge of all district activities. A more extensive reorganization is needed in the Albany street district as described elsewhere in this report.

The machine shop, where hydrants and valves are made, is not a normal district activity. However, the head of this shop should continue to report to the superintendent because of the convenience of physical location.

Engineering is organized in two districts and the head of each district reports direct to the division engineer. It is usually better to organize this type of service on a city-wide basis. It is also desirable that the engineering division take over more responsibility for the maintenance of the distribution system than has been assigned to the present district engineers. The proposed head of the engineering section should also be assistant division engineer and should be given responsibility for the management of the division in the absence of the division engineer.

The plan of organization proposed would be approximately as follows (lines of authority are shown by indentation):

Division Engineer
- Executive secretary
- Engineering section
- Meter repair shop
- Central business office
  - General office
  - Accounting and billing
  - Meter reading
  - Abatements
  - Delinquent accounts

- District maintenance section
  - Office of the superintendent
  - Albany street
  - Brighton
  - Dorchester
  - West Roxbury
  - Machine shop

4. Office of the Division Engineer

As of August 31, 1948 the engineering staff of the division was approximately as follows:

Position	Number of Positions	Pay Rate Weekly	Pay Rate Annual	Annual Cost
Division Engineer	1	$137.71	$7200	$ 7200
District engineer, Grade 5	1	66.94	3500	3500
Draftsman, Grade 3	1	65.03	3400	3400
Transitman, Grade 2	1	45.90	2400	2400
Rodman	1	40.16	2100	2100
Inspector	1	53.55	2800	2800
District engineer, Grade 5	1	74.59	3900	3900
Engineer, Grade 4	1	68.85	3600	3600
Transitman, Grade 2	1	53.55	2800	2800
Senior inspector of castings	1	63.11	3300	3300
Inspector of castings	1	57.38	3000	3000
Totals	11			$38000

Although the two inspectors of castings officially report to the engineers, apparently the senior inspector of castings also reports to the superintendent and the inspector of castings reports to the master mechanic who is in charge of the machine shop. It is recommended that these two positions be eliminated and that the division secure the services of private testing laboratories for inspection of castings. Most of this work is technical, requires special skills and equipment, and must be done at the location of the foundry.

For engineering purposes, the City is divided into two districts and a district engineer is assigned responsibility for each of these districts. The duties of the district engineers include general consultation with the district forces and the approval of material requisitions, purchase requisitions, and service orders.

No periodic checks are made on unaccounted-for water, that is, the difference between the quantity of water received from the Metropolitan Water Board and the metered registration of the water division. A special study made a few years ago indicated that about 32 percent of the water was unaccounted-for. This percentage is about twice as high as it should be. At least a part of this loss is probably due to the lack of maintenance on the water meters and the large number of meters that are reported "stopped" (not registering). A pitometer survey was made a few years ago by private contractors, but no systematic procedures are established for detecting underground water leakage.

The division should establish routine procedures for keeping water leakage at a minimum. The practice of conducting a listening survey in connection with the annual servicing of hydrants and gates should be helpful in locating leaks. Periodic surveys could be conducted by meter readers through listening at curb boxes and at meters. Sometimes leaks can be discovered through instructions to sewer maintenance crews, alerting them to look for excessive flows in sewers during dry weather periods. Periodic listening surveys at critical locations, such as railroad crossings, are also advisable. All of these various methods of reducing and keeping water leakage at a minimum can be initiated and carried out with the regular water division personnel. It is recommended, therefore, that a manual be prepared describing the various techniques used for detecting water leakage; this manual to serve as an instruction guide to water division and other personnel of the City. As a typical example of water leakage that might go unnoticed, except for such instructions, is the checking of areas of excessive vegetation during the summer months. The so-called "springs" that park employes have known to exist for years are often found to be abandoned and leaking services. Similarly, the early melting of light snows on pavements may indicate a leakage that is escaping to the sewer but keeping the ground in that area at a temperature above freezing.

In general, it is believed that a better operation will result if the district engineers are given more overall management responsibilities over the work of the division including the organization and efficiency of crews. They should, for instance, initiate studies of the costs of manufacturing hydrants and gates compared with the cost of purchase of these items and recommend future policies to the division engineer. They should review periodic reports of all operations and determine where and how improvements can be made.

As recommended elsewhere in this report, engineering should be organized on a city-wide basis and the head of the engineering section should also act as division engineer in the absence of the division engineer. It is probable that the engineering staff should be strengthened by at least two positions.

5. Office of the Executive Secretary

The office of the executive secretary is in City Hall and as of August 31, 1948 the staff was as follows:

Position	Number of Positions	Pay Rate Weekly	Pay Rate Annual	Annual Cost
Executive secretary	1	$78.42	$4100	$ 4,100
Investigator	1	57.38	3000	3,000
Clerk	2	51.64	2700	5,400
Clerk	1	47.81	2500	2,500
Clerk	1	42.08	2200	2,200
Totals	6			$17,200

The executive secretary has general responsibility for the clerical work of the division and for the preparation of reports and statistics. The investigator in this office is a lawyer whose duty it is to protect the interests of the City in damage cases. The budgetary accounts of the division are kept by the clerks in this section. They also keep a careful record of purchase orders, service orders, and contracts. The books show not only expenditures but also encumbrances against the appropriate budget items. The auditor's office in City Hall maintains a complete record of encumbrances and reports to all departments each month the expenditure and encumbrance against each budget item. The auditor's books are the official accounts of the City and are always available for examination. It is recommended that the division discontinue keeping this duplicate record.

For the workload of this office, it is believed that two clerical positions can be eliminated and the staff reduced from six to four. However, as recommended elsewhere in this report, other work and employes should be transferred from the Albany street district to this office.

6. Central Business Office

a. General: As of August 31, 1948, the staff and organization of the central business office was approximately as follows:

Organization Unit	Number of Employes	Annual Payroll Cost
Chief clerk's office and misc. employes	20	$ 47,570
Executive clerk's office	6	16,600
Meter reading section	38	100,196
Billing section	22	53,300
Delinquent accounts section	12	29,100
Cashier's section	2	5,800
Totals	100	$252,566

The duties and staffing of each of these units is discussed under appropriate headings in the sections that follow.

The central business office handles all billing, accounting, recordkeeping, and other commercial work except the collection of water bills, which is handled by the City collector's office, and the auditing of accounts, which is done by the City auditor's office. The revenue of the water division is charged each year with a proportion of the costs of the City collector's and City auditor's offices. The charge for auditor services for the year 1947 was $800. This is regarded as reasonable.

It is more difficult to determine whether or not the yearly charge of approximately $160,000 for the collection of water bills by the City collector's office is commensurate with the services rendered by that office. Only one clerk in the collector's office is solely engaged on water bill collection duties, the other clerks and bookkeepers handle the general work of the office in which water collection is included. To determine the adequacy of the charge against the water division would require an examination of the whole of the work of the collector's office.

The accounting and bookkeeping functions of the water division are carried out both at the City Hall and at the Albany street building of the division, the greater part being performed at the City Hall. The division is responsible for the submission of water bills to consumers. The City collector's office is responsible for receiving payments on water bills and the water division keeps the accounts and assumes the responsibility for enforcing payment of delinquent billings. Water accounts for the preceding year which are outstanding in March are collected by the water division by placing liens on the properties concerned. The amounts of the liens are added to the tax bills and recovery is enforced, if necessary, by tax taking.

b. Chief Clerk's Office and Miscellaneous Employes: The staff assigned to the chief clerk and those doing miscellaneous work were approximately as follows:

Position	Number of Positions	Pay Rate Weekly	Pay Rate Annual	Annual Payroll Cost
Chief clerk	1	$70.77	$3,700	$ 3,700
Clerk	1	53.55	2,800	2,800
Clerk	1	47.81	2,500	2,500
Clerk	1	34.43	1,800	1,800
Clerk	2	32.51	1,700	3,400
Clerk	1	51.64	2,700	2,700
Clerk	1	47.81	2,500	2,500
Clerk	1	38.25	2,000	2,000a/
Clerk	4	32.51	1,700	6,800a/
Clerk-typist	1	36.34	1,900	1,900a/
Meter reader	2	61.20	3,200	6,400a/
Estimater	1	61.20	3,200	3,200
Chauffeur	1	47.50	2,470	2,470
Meter reader	2	51.64	2,700	5,400b/
Totals	20			$47,570

a/ Under general supervision of the head of the billing section.

b/ Assigned to districts but on City Hall payroll.

The business office of the division at the City Hall is under the control of a chief clerk. This office is responsible for reading the water meters, billing the customers, and keeping a record of the collections of current account receipts. The meter repair shop is also under the supervision of the chief clerk. The work of this shop is considered elsewhere in this report and, as discussed later, it is recommended that the control of the shop be transferred to another official.

The chief clerk has thirteen clerks and supervisors reporting direct to him. In addition, he handles a considerable amount of detail work himself, dealing with telephone and personal complaints from customers and giving telephone instructions to the meter shop at Albany street. He should be relieved of much of the detail work and be given more time to handle the broader administrative problems of his office. Placing the meter repair shop under other control will relieve him of the responsibility for this activity. Other recommendations made in this report provide that those reporting direct to the chief clerk be limited to the two clerks in his own office, the billing supervisor, the chief meter reader, the estimator, the delinquent accounts inspector, and the executive clerk.

In general the main activities of the business office are handled in an efficient and workmanlike manner, but this is not true of the "fringe" activities. There are, in the office, ten clerks whose duties are not clearly defined. They serve as substitutes for employes who are absent, and as "floating labor" to be applied where pressure is greatest, such as doing the work in the billing office of sorting receipt stubs, processing changed address notices, and filing meter books. However, they are an extra staff and sometimes are not needed in the normal operation of the office. The work of these ten clerks could probably be performed by five clerks if their work was properly correlated and supervised. The stuffing and mailing of bills, if the suggestions for uniform placing of addresses and the purchase of a folding and enveloping machine are adopted, would provide less than full-time employment for one clerk. Only two clerks are needed to operate the printing and addressograph machines. It should be possible to carry out the ordinary activities of the office with six fewer clerks than the number employed on September 28, 1948. By this reduction in staff, the annual saving would be $10,200.

If the staff is reduced as suggested, there would not be a sufficient number of employes available to compile the lien lists each spring and temporary clerks would have to be hired for this duty. However, this practice is followed now so there would be no additional expense.

The clerk who supervises miscellaneous clerical work is largely concerned at present with preparing and checking the payroll of the business office and in supervising the work of other clerks. It is proposed elsewhere that all payroll accounting for the division be done at the City Hall, and it is recommended that

this clerk be used exclusively on payroll duties such as the recording of sick leaves, holidays, and vacations for all division employes. Two other clerks on the payroll do not actually work in the business office. One is engaged on the processing of garage requisitions, service orders, and contracts and should continue to handle this work. The other is employed in the division engineering office and should be transferred to the payroll of that office.

c. Executive Clerk's Office: The staff of the executive clerk's office was as follows:

Position	Number of Positions	Pay Rate Weekly	Pay Rate Annual	Annual Payroll Cost
Executive clerk	1	$66.94	$3,500	$ 3,500
Clerk	3	51.64	2,700	8,100
Clerk	2	47.81	2,500	5,000
Totals	6			$16,600

The executive clerk is responsible for interviewing customers calling at, or telephoning, the water division office regarding special inquiries and complaints. He is assisted by four interviewers and a clerk-stenographer in negotiating abatements and adjustments of customers' accounts, in processing complaints regarding leaks and low pressure, and in handling requests for new services. The work is largely concerned with requests for abatements or reductions in amounts billed for water. It can be expected that the number of such requests are large when 16 percent of the bills are estimated because of "stopped" meters. In the year 1947, there were 2,327 abatements of water bills amounting to a total of $68,726.

The executive clerk refers requests for abatements, where no error in meter reading is shown, to the chief clerk for decision. The impression is given that the water division is most anxious to maintain good customer relations and that abatements are given when any reasonable plea is advanced. It also seems that too many abatement requests have to be referred to the chief clerk since there are no explicit instructions as to when and to what extent abatements are to be allowed.

The present system of allowing abatements leaves too much discretionary authority to employes. The large amount of $68,726 granted in one year would make it appear that it would be possible for abuses to creep into the system. It is desirable that the abatement procedure be spelled out in detail and that the method of adjustment be made very specific. Very little latitude should be granted to an employe making an adjustment. Such a policy as proposed would not only help to prevent abuses, but would improve public relations. The City would handle every case in the same manner and the customers would know the method of granting

abatements. For example, one method of abating a bill where excessive leakage occurred would be to require an inspection report by a division employe or a paid invoice showing the plumbing work done and the nature of the leakage. Once it was established that a leak did exist, the division could provide that the bill should be adjusted to an amount 50 percent greater than a normal bill. It is recommended, therefore, that a manual be prepared spelling out the procedure for considering and making adjustments in water bills.

d. Meter Reading Section: The staff of the meter reading section was approximately as follows:

Position	Number of Positions	Pay Rate Weekly	Pay Rate Annual	Annual Payroll Cost
Chief meter reader	1	$61.20	$3,200	$ 3,200
Supv. meter reader	2	55.46	2,900	5,800
Meter reader	22	51.64	2,700	59,400
Meter reader	3	49.73	2,600	7,800
Meter reader	2	47.81	2,500	5,000
Meter reader	2	45.90	2,400	4,800
Repairer (clerk)	1	50.50	2,626	2,626
Laborer	5	44.50	2,314	11,570
Totals	38			$100,196

There are about 95,000 meter readings to be made each quarter and the employes assigned to this activity, on September 28, 1948, were 23 regular meter readers and 6 "pick up" and complaint readers. Meter cards are bound in books of about one hundred cards, each book comprising about one day's work for a reader. There are 1,034 books, of which number, 105 are for outside meters only. Division statistics show that on December 31, 1947, there were 99,640 meters installed and that in 2,302 places connecting pieces (spacers) had replaced meters which had been removed because of defects, or for other reasons. No readings are made of meters installed in public schools or in City premises, and many meters formerly in these locations have been removed and placed in premises where a charge is made for water consumed.

The reading of meters is organized on a ward basis. The 22 wards are divided between the two meter reader supervisors, each having under his control half the available readers. No cars are furnished for supervisors or readers. The readers report to the City Hall office each morning, receive instructions, and pick up their meter books. They do not report to the office again until the following morning when they return the book with the new readings, the date of reading, and their initials added to each card. The meter readers also complete a form showing the number of actual readings made and report any "stopped" and broken meters. The six "pick up" readers are used to obtain special readings requested by customers, to check unusual consumptions, and also to get readings

where the regular reader has repeatedly failed to get access to the meter. For reading outside meters the reader is accompanied by a laborer to lift inspection covers and to prevent accidents while inspection pits are uncovered.

Access to meters in the older parts of the City is often difficult because the meters are beneath the floors of rooms now used as living rooms or as coal cellars. The regulation that meters must be kept accessible is often disregarded and the readers have to move obstructions to get to the meters. Since the length of the reader's work day is governed by his success in covering the allotted territory, he does not willingly spend time discussing meter locations with the householders. It is recommended elsewhere in this report that a program be initiated for relocating meters that are inaccessible and for providing new connections so that meters can be changed easily. The reading of outside meters is made difficult by heavy snowfall and during the winter months these readings are often skipped.

The laborers in the meter reading office, in addition to assisting in the reading of outside meters do clerical work such as sorting of old meter cards and preparing and binding of new ones. They also help in the folding and enveloping of bills. They are not likely to be as adept at this kind of work as are junior clerks, but their rate of pay is considerably higher than that of a clerk. It is believed that not more than three outside meter books are read in any one day and this requires only three laborers. Since only 105 outside books are read in a quarter only 105 man days of work are needed of laborers, plus a small margin for extra readings. It is recommended that the number of laborers be reduced from five to three.

The reading of 1,034 books requires 52 man days of work a quarter for each of twenty readers. There are 60 or more working days in each quarter so that the margin should be sufficient to take care of absences due to sick leave and holidays. Provision must also be made for the vacation period which is normally confined to the July-September quarter. There would be only 50 work days in this quarter if each reader takes two weeks of vacation time. In 1948, the readings for this quarter were completed by an average reader strength of 23 with four working days to spare. It is suggested that vacations for meter readers be distributed over a greater period of time to avoid the need for staffing the unit so that all vacations can be taken in one reading period. The number of "pick up" readers should be reduced from six to four. These readers also could be assigned the task of reading the various meters located on federal government property and those on the harbor islands, where considerable time is spent in traveling.

Furthermore, it is believed that the average workload of 100 meter readings a day is too low by at least 20 percent. Until the meters are properly located it will not be possible to obtain the best efficiency from readers, but even under present conditions some improvement should be expected. The number of meters assigned to a book and a day's work should vary according to the conditions. In some areas as many as 150 meters a day or more should be read by one reader. Probably 120 meters a day would be a good overall average workload for a meter reader.

Total reductions of eight employes should be made in this section, including four regular meter readers, two "pick up" meter readers, and two laborers for payroll savings of $19,600 a year.

e. Billing Section: The staff assigned full time to the billing section was about as follows:

Position	Number of Positions	Pay Rate Weekly	Pay Rate Annual	Annual Payroll Cost
Supervisor clerk	1	$61.20	$3,200	$ 3,200
Clerk (sec'y)	1	45.90	2,400	2,400
Bookkeeper	1	57.38	3,000	3,000
Clerk (computor)	1	57.38	3,000	3,000
Clerk (computor)	1	55.46	2,900	2,900
Clerk (computor)	1	49.76	2,600	2,600
Clerk (computor)	1	40.16	2,100	2,100
Clerk (unit)	1	47.81	2,500	2,500
Clerk (unit)	1	45.90	2,400	2,400
Clerk (unit)	2	43.99	2,300	4,600
Clerk (unit)	2	42.08	2,200	4,400
Clerk (billing)	1	47.81	2,500	2,500
Clerk (billing)	1	40.16	2,100	2,100
Clerk (billing)	1	36.34	1,900	1,900
Clerk (billing, temp.)	2	32.51	1.700	3,400
Clerk (printing)	1	47.81	2,500	2,500
Meter reader (addressing)	1	61.20	3,200	3,200
Clerk (addressing)	1	32.51	1.700	1.700
Clerk (mailing)	1	55.46	2,900	2,900
Totals	22			$53.300

The work of the billing section is being executed competently and carefully. The delay between the reading of the meter and the mailing of the bill is never more than six days and is usually only four. During the second quarter of 1948, a total of 93,507 bills were prepared by this section.

Present practice is to read meters and send out bills every three months. Each bill shows the date of meter reading, present and previous meter reading figures, consumption for the quarter, charge for the quarter, arrears since the beginning of the year, and the total amount now due. No discount is made for prompt payment, nor is there any penalty for delaying payment during the current year.

The payment of water bills is made to the City collector and he accounts daily to the water division for receipts on current accounts. At the end of each year, a notice is sent to all delinquent accounts that failure to pay will result in a lien being placed on the property. These lien warning notices are mailed in March each year and the arrears enumerated are those for the previous year. About the end of April or early in May the liens are

actually placed on the property and the amount is added to the tax bill sent out by the collector's office in June or July. The effectiveness of this collection policy may be judged by the figures for 1947 water bills. There are approximately 93,500 customers.

Lien Action	Number	Amount	Percent of Total Customers
Lien notices mailed	22,158	$633,000	23.7
Liens placed	8,570	258,000	9.2
Liens added to tax bill	6,919	211,000	7.4

The large number of lien notices mailed is due to the fact that they follow so closely (60-150 days) on the mailing of bills for the last quarter of the year, many of them being for that quarter only. Although 23.4 percent of all customers are delinquent when notices are sent only about one-third this number are delinquent at the time the lien is added to the tax bill.

The organization of the billing office was:

	Number of Positions
Supervisor	1
Bookkeeper	1
Computers	4
Unit clerks	6
Multiple adding M/C operator	1
Bookkeeping M/C operators	4
Printing M/C operator	1
Mail clerk	1
Total	19

Bookkeeping is by a stub system and no customer ledger card is maintained. The stub is a tear-off portion of the bill and contains the name of the customer and address of the premise concerned, together with figures relating it to a particular meter card book. The stub shows the current charge, the arrears, if any, and the total amount due. Each of the unit clerks keeps the stubs relating to certain of the City wards, filing them by batches corresponding to meter books. When a payment is made to the City collector, a portion of the customer's bill is detached and returned to the billing office and then routed to the unit clerk concerned. Here it is matched with the business office stub which is withdrawn from the active file leaving only stubs for accounts due. The only semblance of a customer's ledger is the meter reading card which shows the current charge and also any arrears that were due when the last billing was made. Payments of bills are not recorded on the card but are indicated by the absence of arrears.

The computors receive the meter books with the latest readings shown and add the consumptions and charges. The books then pass to the unit clerks who, working from the appropriate blocks of stubs, add the arrears shown to be due. The meter books then pass to a multiple adding machine which registers the consumption from each card in columns corresponding to the charge zones on which charges are based. The sheet containing the record of a book is totaled by the machine and the amount of billing of the total consumption is computed and shown on the sheet. The book then passes to a bookkeeping machine operator where it is matched with a batch of bills from the printing machine corresponding to that block. In a single operation the bookkeeping machine prints on each bill, receipt stub, business office stub, and on a commitment sheet for the whole batch, the consumption figures, the current charge, any arrears, and the total amount due. The commitment sheet is totaled for all of the cards of the book being processed.

The meter book is then filed and the commitment sheet and the batch of bills pass to the unit clerk who detaches the stubs, adds their totals on an adding machine, and if the total agrees with that shown on the commitment sheet, he initials the latter. The stubs are then placed in the active file. The commitment sheet and corresponding bills then pass to the bookkeeper who compares the total on the commitment sheet with that shown on the sheet from the multiple adder which has divided the consumption figures into zones. If these two sheets agree in total, an accurate check has been obtained on the work of the computors.

The bookkeeper has a separate ledger account for each unit clerk and he debits to that account the total dollar amount shown on the commitment sheet and passes the batch of bills to the mail clerk, who puts them through a folding machine, places them in envelopes, and sends them to the collector's office where they pass through a postal franking machine and are mailed.

When payments of water bills are made to the City collector, the stubs are detached from the bills and retained. Each day, these stubs are sent to the billing office in the water division together with a sheet listing all receipts for the day itemized and totaled by City wards. The receipt stubs are sorted, by the billing section, into wards and are sent to the appropriate unit clerks. Each unit clerk is credited with the total shown sent to the unit. The unit clerk checks the total of receipt stubs and withdraws from the file, the stub matching the receipt stub. Where the amount paid is not that for the latest bill rendered, but for an earlier one, an appropriate notation is made in ink on the debit stub, which is retained in the active file.

At the end of each quarter, when all bills for that quarter have been sent out, and before any bills for the new quarter are processed, each unit clerk balances the total of the debit stubs held in the unit against the total shown in the bookkeeper's unit ledger account. Any discrepancy shown must be reconciled before the next quarter accounts are opened.

A minimum charge of $8.00 a year is made for any metered supply where consumption is 5,300 cubic feet, or less. The meter is read quarterly and if the reading is above 5,300 cubic feet, a bill is presented for the excess amount consumed. A minimum bill for $8.00 is submitted with the first quarter's billing, and is re-submitted each quarter until it is paid, or failing payment, is added to taxes. No pressure is exercised to obtain payment of the bill before the close of the year, but many bills are in fact paid during the first or second quarters, making it unnecessary to bill those consumers again during the current year. Although this method of billing in advance for the year is unusual, considerable savings result from the procedure. The number of minimum account consumers in 1947 was 25,785.

The billing system in use has been followed since 1938. It is simple in operation; bills are submitted promptly, and administrative costs are not high. Enough checks and safeguards have been introduced to prevent fraud and to discover and correct any errors at an early stage. No book of cards is read by the same meter reader or figured by the same computor twice in succession, thus guarding against the repetition of clerical errors or fraudulent readings. The addressograph plates are kept in locked files and are handled only by the printing machine and addressograph operators who do not handle meter books. If a card were lost from the meter book, its absence would be noted at the bookkeeping machine since there would be a bill form with no card to match it. The computor's calculations are checked by the multiple adder as already noted. If a receipt stub were lost or matched with a wrong debit stub by error of the unit clerk, the customer concerned would protest against arrears charged on the next bill. The quarterly reconciling of unit balances against ledger accounts assures that errors cannot go beyond one billing.

The machines used in the billing office are:

1 Multiple adding machine
3 Triple print electric-operated bookkeeping machines
1 Printing machine
2 Graphotypes to print address plates
1 Addressograph machine
7 Desk adding machines
1 Folding machine

The bill form in use has space for two addresses, the upper one being for the premises where the meter is situated, the lower for the address of the person to whom the bill is to be sent when this differs from the address above. The bills are mailed in window envelopes and at present it is necessary to sort them to determine that the correct address is in register with the window. Two types of envelopes are used, one for each location of address. All bills are sorted by hand after leaving the folding machine and are then inserted in envelopes by hand. It is recommended that the addressograph plates be changed to ensure that the correct mailing address is always printed in the lower of the two address spaces. A machine should then be purchased which will fold and stuff the bills in one operation and save the salary of one clerk position.

The mail clerk who stuffs the bills and also the operator of the printing and addressograph machines at present report direct to the chief clerk. It is recommended that they be placed under the direction of the billing supervisor clerk since their work is part of the billing operation.

f. Delinquent Accounts Section: The staff assigned to delinquent accounts was as follows:

Position	Number of Positions	Pay Rate Weekly	Pay Rate Annual	Annual Payroll Cost
Inspector	1	$57.38	$3,000	$ 3,000
Constable	9	43.99	2,300	20,700
Investigator	1	63.11	3,300	3,300
Rodman	1	40.16	2,100	2,100
Totals	12			$29,100

The delinquent accounts section of the business office consists of an inspector assisted by nine constables, an investigator, and a rodman. The titles are classifications only and the staff, in fact, all carry out like duties. The first duty of the section is to trace customers whose bills are returned by the post office as non-deliverable. The activity is necessary not only to maintain correct mailing addresses and to ensure that bills are addressed to appropriate persons, but also to ensure that liens placed are not rendered inoperative because of incorrect addresses.

The section also takes steps to enforce payment of delinquent bills of more than $50.00 in amount and usually commercial accounts, but this is secondary to the tracing of addresses. Bills on which collection action is to be taken are selected by the inspector by an examination of unit files. A failure to pay notice is followed by shutting off the water supply which is reconnected only after payment of the account plus an additional $2.00 shut-off charge. It is reported that shut-off procedure is not used against private householders because the health department disapproves of depriving any dwelling of water.

Since the division is able to collect its overdue accounts through the collector's office by placing liens and adding the amounts to tax bills, it is probably wise not to adopt a shut-off policy. This is particularly true from the division's point of view since it is credited in full with amounts collected through the tax bill procedure and has no collection expenses to meet. No demands are sent to customers who fail to pay promptly until the lien procedure is initiated. The sending of such demands, say one month after the original bill, might bring in some payments, but the processing of them would add to department expenses by making it necessary to search unit files and to select certain plates from the address files. The division has been successful in reducing considerably the amount of outstanding water accounts since the

adoption of the policy of using shut-off methods for the large delinquent accounts and this policy should not be changed unless experience changes and the total of outstanding bills increases considerably. It is not believed that the offer of a discount for prompt payment or a penalty for delay in payment would produce results favorable enough to offset the added complications they would introduce in the bookkeeping system.

The constables working in the delinquent accounts section are appointed by the mayor and City council. Division control over them is loose, but the present crew is reported to be doing a satisfactory job. The investigator is an old City employe who is awaiting retirement. No figures are available to show the accomplishments of the section so far as the collection of delinquent accounts is concerned. The work of verifying and correcting addresses is important and necessary and it is also necessary to be able to put pressure on those using large quantities of water who habitually fail to pay bills.

Data should be collected on the number of addresses corrected and the number of delinquent accounts processed and a workload determined so that the results of the work of individual employes can be evaluated.

g. Cashier's Section: The staff assigned to the cashier's section was as follows:

Position	Number of Employes	Pay Rate Weekly	Pay Rate Annual	Annual Payroll Cost
Clerk-cashier	1	$61.20	$3,200	$3,200
Clerk	1	49.73	2,600	2,600
Totals	2			$5,800

The clerk-cashier and his assistant do not handle water consumption bills; their duty is to collect the deposits made by customers for work to be executed by the department. Deposits are made against an estimated cost and an adjustment is made after the work is completed and the actual cost determined. Deposits are held in a special bank account and payments are handed to the City treasurer after the bill has been submitted.

The estimator and chauffeur on the staff of the business office are engaged in estimating the cost of the work on which deposits are paid. For new supplies of three-quarter inch, a fixed charge of $55.00 is made; for larger services, an estimate is prepared entailing a visit to the premises concerned.

7. Meter Repair Shop

As of August 31, 1948 the staff assignments to the meter repair shop were approximately as follows:

Position	Number of Positions	Pay Rate Weekly	Pay Rate Annual	Annual Payroll Cost
District foreman	1	$63.11	$3300	$ 3,300
Inspector	2	57.38	3000	6,000
Clerk	1	57.38	3000	3,000
Clerk	2	47.81	2500	5,000
Clerk	1	32.51	1700	1,700
Machinist	1	53.50	2782	2,782
Chauffeur-mechanic	1	50.50	2626	2,626
Repairer	8	50.50	2626	21,008
Plumber	2	50.50	2626	5,252
Laborer	5	44.50	2314	11,570
Totals	24			$62,238

Standards for maintenance and for testing of water meters are very low. There are approximately 16,000 water meters that are "stopped" (not registering) but have not been changed, some of which have been stopped for two years. In such cases bills are rendered on an estimated consumption rather than on an actual use basis.

There has been no established policy for bringing meters in for regular periodic testing. Instead, meters are brought in on a complaint only. Most water meters function on a positive displacement basis, and after a period of use they often become worn and are slow in registration. This is particularly true on small flows such as are caused by leaking plumbing fixtures. The policy on testing meters is to test to the 1/8" stream only, which is a considerable flow of water. Such tests should be made on the 1/16" stream so as to maintain accurate registration on very low flows.

Meter installations vary widely and in some instances exchanges are made difficult due to inaccessibility and to non-standard connections. As a consequence, if a meter is stopped or needs servicing, a considerable amount of work is necessary in order to exchange the meter. It is recommended that a program be instituted for changing meter settings, where needed, so that the meters can be exchanged or serviced easily and so that they are accessible for meter reading.

It would appear that the whole meter shop operation has received too little attention during the past few years and, as a consequence, the City found itself in a difficult situation during the war years for maintaining and replacing meters. The reason cited for the large number of "stopped" meters is that the City has been unable to get parts or new meters. It is expected that this situation will be improved. In view of the fact that many of the meters

have never been brought in for service, that approximately 16 percent of all meters are "stopped" and estimated consumptions are made, and further that meter testing is not extended to include the small streams, it would seem that the City is losing as much as 10 percent of its revenues from water use, or a total of $500,000 a year. This estimate is also supported by the fact that only 68 percent of the water received in the Boston distribution system is accounted for. In a tight and well-metered system this percentage should approach 85, so that the difference between 68 and 85 percent, or 17 percent, is probably due to lost registration and to leakage.

It is evident, therefore, that more attention should be given to the meter shop and an aggressive program should be initiated to replace existing "stopped" meters and to begin servicing meters on a periodic basis. New testing and other meter shop equipment should be procured and probably two crews added for replacing "stopped" meters with new meters. One of the conditions noted in the regular shop operations was the cleaning of old meters by hand with water. Solutions are available that greatly simplify this method of cleaning and at the same time do a much better job.

It is pointed out that recent changes made in the supervision of the shop have already resulted in improvements and should result in still greater improvement. The line of authority from the foreman in the shop should not extend through the chief clerk in the billing and bookkeeping section, but rather should be direct to the division engineer. The work of this shop, even though it is small in comparison with other division activities, is sufficiently important to warrant supervision by the head of the division.

It would appear that the district forces could take over more responsibility for exchanging and doing minor field servicing of meters in the field. If the district crews were given responsibility for all meter work including the periodic changing of meters, the work could be planned with other maintenance work of the district for more economical operation. The meter shop should continue to do all actual repair work and testing and keep the districts supplied with repaired meters.

It was noticed that some of the meter connections were not sealed. It is a relatively simple matter to reverse a meter, if not sealed, for a portion of the billing period and thereby reduce the quantity of water registered. It is recommended that all meter connections be sealed.

Many things should be done to raise the standard of operation of the meter repair shop including:

(a) Purchase modern repair equipment.
(b) Purchase an adequate supply of new meters.
(c) Standardize on two or three meters.
(d) Stock an adequate supply of repair parts.

(e) Hire and train an adequate number of competent employes.
(f) Strengthen supervision to obtain a full work day from each employe.
(g) Purchase gang testing equipment and test meters on the 1/16" stream.
(h) Service all meters once every ten years.
(i) Change meter connections to make all meters accessible and easily exchanged.

It is believed that the present shop foreman, the division engineer, and the commissioner of public works are each aware of these conditions and that a plan for their correction is now underway.

8. Machine Shop

As of August 31, 1948, there were 31 employes in the machine shop as follows:

Position	Number of Positions	Pay Rate Weekly	Pay Rate Annual	Annual Payroll Cost
Master Mechanic	1	$59.29	$3100	$ 3,100
Asst. Master Machinist	1	55.46	2900	2,900
Machinist	11	53.50	2782	30,602
Machinist	1	50.50	2626	2,626
Machinist	4	47.50	2470	9,880
Asst. Machinist	2	47.50	2470	4,940
Repairer	4	50.50	2626	10,504
Blacksmith	1	50.50	2626	2,626
Laborer	6	44.50	2314	13,884
Totals	31			$81,062

The machine shop is largely concerned with manufacturing gates and hydrants. There are no watchmen or clerks working in this section. In fact the absence of records makes it difficult, if not impossible, to determine the efficiency of shop operations. It was reported that the costs for manufacturing are a little higher than would be the cost of the items if purchased on the open market. Also it is pointed out that the division believes that it is making a superior product and that it is worth more.

As a very minimum the division should set up a simple system of records to obtain reliable data on costs to make comparisons with outside prices and to establish administrative control over costs.

The classification of "repairer" is used as a junior machinist. One of the laborers operates the freight elevator and another acts as janitor. The rest of the laborers move castings and do other miscellaneous work around the shop.

The machine shop is under the supervision of the superintendent of maintenance. This arrangement is probably a result of the convenience of the physical location of the machine shop to the superintendent's office; both are in the same building. No better arrangement is apparent under the limitations of existing facilities. If the engineering and other offices are consolidated in the same building it would seem that the machine shop should be under the direct supervision of the division engineer.

9. District Maintenance

a. Plan of Organization: For water distribution maintenance purposes the City is divided into four districts or geographic areas - Albany Street, Dorchester, West Roxbury, and Brighton. These districts are organized, under district foremen, with staff approximately as follows:

	Number Employes	
General district office		19
Albany Street district		170
Repair gangs	20	
Outside employes	35	
Plumbing shop	23	
Hydrants and gates	19	
Emergency crews	45	
Albany Street yard	20	
Charlestown sub-yard	8	
Dorchester district		21
West Roxbury district		25
Brighton district		16
Total district staff		251

As shown by this tabulation, the districts are not organized to equalize the work loads. The Albany Street district includes most of the heavily built up sections of the City and is many times larger than any of the other districts. The organization pattern of the Albany Street district varies from the other districts in that the crews are quite highly specialized. More is said of this organization elsewhere in the report.

An example of the work load of the districts, as revealed by the complaints received during the month of August 1948, is shown as follows:

Service Calls	Districts: Albany Street	Dorchester	W. Roxbury	Brighton	Total
No. of complaints	556	298	720	185	1759
No pressure	132	102	137	31	402
Service leak in basement	82	95	45	46	268
Service leak in street	132	101	129	43	405
Main pipe leaks	12	2	2	7	23
Hydrant and gate leaks	13	9	10	1	33
New services	52	4	20	2	78
Other requests	142	125	321	5	593

The three smaller districts are staffed to handle a normal amount of work and during times of emergency these districts call upon the Albany street forces for assistance. Similarly the repair of large mains, gates, and of some hydrants is assigned to the Albany street crews. However, it is reported that such calls are infrequent and are made only a few times a year.

Some of the staff of the Albany street district other than those sent out on emergency repair work is chargeable to the other districts. The plumbing shop makes up connections which are supplied to the districts, the yard forces are used to supply the districts with materials, and the emergency crews assigned to the Albany street district serve the entire City during off-hours.

Although the district foremen are officially under the supervision of the superintendent such supervision is spotty and infrequent. Instead of giving general supervision to all districts the superintendent is serving as a foreman of the Albany street district due to the fact that this district has no head. A complete reorganization of this district is desirable as described elsewhere in this report.

b. Office of the Superintendent: As of August 31, 1948 the staff of the office of the superintendent was approximately as follows:

Position	Number of Positions	Pay Rate Weekly	Pay Rate Annual	Annual Payroll Cost
Superintendent	1	$66.94	$3500	$ 3,500
Inspector	3	57.38	3000	9,000
Inspector	1	55.46	2900	2,900
Chief Clerk	1	63.11	3300	3,300
Clerk (storeroom)	1	55.46	2900	2,900
Clerk (payrolls)	1	53.55	2800	2,800
Clerk (payrolls)	1	47.81	2500	2,500
Clerk-estimator	1	47.81	2500	2,500
Clerk-costings	1	47.81	2500	2,500
Clerk-secretary	1	49.73	2600	2,600
Clerk (files)	1	47.81	2500	2,500
Clerk (stock records)	1	47.81	2500	2,500
Clerk (permits)	1	43.99	2300	2,300
Clerk (shut-off records)	1	47.81	2500	2,500
Clerk (work records)	1	47.81	2500	2,500
Switchboard operator	1	47.81	2500	2,500
Janitor	1	50.50	2626	2,626
Totals	19			$51,926

The payroll accounts for the whole water division are kept by this staff as are also the records of tax deductions and of retirement pension payments. This work should properly be under the supervision of the executive secretary in the City Hall offices.

The assignments of the work of this office are shown in the tabulation and are described more fully in the following paragraphs.

A clerk has charge of a storeroom that is located on the third floor of the Albany street building. This clerk is assisted by a mechanic but carried on the payroll of the plumbing shop. Another clerk is secretary to the superintendent, and handles files, correspondence, and telephone calls. Two clerks spend their full time preparing payrolls for the entire water division. Most of the time of seven clerks is used in keeping records. The switchboard operator and a janitor are also on this payroll.

As in the case of payrolls, it would be desirable to have these records kept in the main office in the City Hall but it would be difficult to make this transfer unless other office activities were also consolidated in one office.

The Albany street office carries a complete set of records for stores control. Two registers are kept showing material requisitions and receiving reports. It is believed that the convenience offered by these duplicate records does not warrant the expense of keeping them.

The Albany street district yard provides for the main storage of all materials for the division. The storage is in the central storeroom and in the open yard. Good inventory control records are kept of these materials and issues are made to district yards only as the materials are needed. No records are kept of the stock carried at the other districts and it is reported that regular inspections are made to determine that district stocks are kept at a minimum.

10. Albany District

a. Organization: The maintenance of the water distribution system in the Albany street district is performed by various groups of employes working under a confused plan of organization. Such work is now handled by a plumbing shop, a"repair gangs" unit, an "outside employes" unit, an emergency crews unit, and by a unit called hydrants and gates. The hydrants and gates unit is relatively independent of the other units. Emergency crews are organized under a district foreman who has an emergency force on duty at all times including the regular day shift. "Repair gangs," is a small unit of 20 employes organized under a district foreman, and concerned principally with shut-off and turn-on work, the operation of portable compressors for other gangs, special work on hydrant and gate repairs, and miscellaneous investigation work.

The "outside employes" group is principally the labor crews that do the excavation and backfilling for other crews. The actual repairs of a plumbing character are handled by the plumbing shop most of whom work in the field. In addition to the various groups of City employes, the division employs a contractor who has a number of crews that do labor work similar to the "outside employes" group.

The work of the district is organized about as follows: The district foreman in charge of the "repair gangs" is in charge of assignments. All complaints are handled by this employe. All of his work is handled from his desk as he does no actual supervising of field crews. For purposes of clarity in this report, he will hereafter be called "inside foreman." Complaints of emergency character are assigned by the "inside foreman" to the emergency crews who make the initial investigations but seldom do more than shut off the water where damage warrants such action. After the investigation is made the work is reassigned by the same "inside foreman" to the contractor or to the City labor "inspector" who supervises "outside employes." At the time of assigning the work to the labor crews the inside foreman also notifies the plumbing shop foreman of the assignment so that he can arrange to have plumbers on the job, after the trench is opened, to make the repairs. If a compressor is needed for breaking the pavement or if a tap is to be made the inside foreman assigns this work to his employes who handle such special tasks.

On a single repair job the following procedure is typical:

(1) Complaint is referred to "inside foreman" in charge of "repair gangs."

(2) Complaint is assigned by "inside foreman" to the emergency crews for investigation.

(3) Emergency crews report findings.

(4) Repair order is given to the inspector in charge of "outside employes."

(5) Notice is given to plumber foreman of repair order.

(6) Order is given to chauffeur who operates portable compressor to break pavement.

(7) Order is given to tapping crew to make tap.

During the actual repair four different crews working under three different foremen are on the job but not necessarily at the same time. If a major hydrant or gate repair is needed such work would be assigned to the special crew working for the "inside foreman." For minor hydrant repairs the work might be sent to the hydrant and gate unit under a different supervisor.

An improved plan of organization would make possible substantial savings in staff. All of the repair work should be performed under one supervisor instead of various district foremen. The plumbers, repairers, compressor operators, and laborers working as a crew or group of crews, should report to one head or foreman. There would probably be four or five foremen for the district and each would have a compressor and a sufficient number of plumbers, repairers, and laborers to handle all work assigned. Under such a plan of organization it would be possible to coordinate all of the work under one foreman to reduce the time lost due to improper scheduling of crews. The supervisory positions in charge of hydrants and gates, repair gangs, outside employes, and plumbing shop would not be needed. Instead there would be a district supervisor in charge of all repair work in the district and four or five foremen in direct charge of the crews. The present plan of organization is too specialized for efficient operation. The proposed plan should be developed around areas and the staffing under each area foreman should be capable of all types of work including the making of taps, the repair of hydrants and gates, the inspection of hydrants and such "regulating" as is needed.

It is estimated that the loss to the city resulting from over-specialization amounts to about 25 percent of the payroll of the employes working in these specialized units. As of August 31, 1948, the staffs that would be consolidated under this plan of organization were as follows:

Organization Unit	Number Employes
Repair gangs	20
Outside employes	35
Plumbing shop	23
Hydrants and gates	19
Total	97

The estimated savings would be about 24 positions whose annual salaries would total about $60,000.

During the regular day shift, there is also overlapping between the various repair crews and the emergency crews. It is recommended that the emergency crews be reduced in size and consolidated with the district organization during the day shift so that the investigation work would be handled by the proposed foremen. It would seem that off-and-on work could be combined with emergency investigatory work and handled by the same crews. One such crew would work under each of the foremen. The size of the off-and-on crew should be reduced to one man except for unusual jobs.

b. Albany "Repair Gangs": As of August 31, 1948, the staff assigned to the unit known as "repair gangs" was as follows:

Position	Number of Positions	Pay Rate Weekly	Pay Rate Annual	Annual Payroll Cost
District foreman	1	$63.11	$3300	$ 3,300
Repairer	8	50.50	2626	21,008
Repairer	2	47.50	2470	4,940
Emergency man	1	50.50	2626	2,626
Chauffeur-mechanic	1	50.50	2626	2,626
Chauffeur-laborer	5	47.50	2470	12,350
Laborer	2	44.50	2314	4,628
Totals	20			$ 51,478

The district foreman in charge of "repair gangs" handles complaints and work assignments for all outside district work and also has a number of special crews working under his supervision. He has one hydrant repair crew that makes all special hydrant repairs including some work in other districts, three off-and-on crews of two employes each, one tapping crew of two employes, and five compressor crews of one employe. These crews do very little excavation work and even in the case of the hydrant crew, other laborers from the "outside employes" unit do the actual excavation and backfill work.

The "repair crews" unit should be consolidated with other maintenance crews as recommended elsewhere in the report. Under the present arrangement too much time is lost due to the difficulty of scheduling crews where more than one crew is assigned work on a

single job. Breaking the pavement, making a tap, repairing a service break, excavating a hole, and repairing a gate, each requires the services of a specialized crew.

As of September 1948 there was a backlog of emergency repair work on some 50 or 60 leaks. It was reported by the division that this number has been as high as 150. However, there are thousands of so-called dead services that have not been plugged at the main. As such services are a source of leaks it is recommended that a program be established for "killing" abandoned services at the main where it is determined that such services will not be needed. Such a program could be developed so as to maintain a constant work-load throughout the year, reducing the work as emergency repairs increase and increasing the work as other maintenance requirements are reduced. The backlog of current leaks that need attention should be reduced well below the present 50 or 60.

Elsewhere in this report it is estimated that 24 positions can be saved by adopting the proposed plan of organization. Instead of reducing the staff immediately, it is further recommended that some of the staff be used to reduce the backlog of leaks and start the program of plugging abandoned services at the mains.

c. Albany "Outside Employes": As of August 31, 1948, the staff assigned to the unit known as "outside employes" was as follows:

Position	Number of Positions	Pay Rate Weekly	Pay Rate Annual	Annual Payroll Cost
Inspector	1	$53.55	$2800	$ 2,800
Mason	1	53.50	2782	2,782
Cement finisher	2	50.50	2626	5,252
Repairer	14	50.50	2626	36,764
Repairer	3	47.50	2470	7,410
Chauffeur-laborer	1	47.50	2470	2,470
Laborer	13	44.50	2314	30,082
Totals	35			$ 87,560

The organization unit known as "outside employes" is the principal labor force of the district. The 35 employes are normally divided among 11 gangs doing excavation work. One employe acts as a chauffeur for the inspector in charge of the crews. It is recommended that this position be eliminated. This unit should also be consolidated with other maintenance units in the district so that all work could be performed under the supervision of one foreman.

A typical example of the type of work performed by these crews and the possibilities of lost time due to waiting for other crews is shown in the normal repair of a leak at the corporation cock. Such a leak is under the pavement so the labor crew normally waits until a compressor arrives and the pavement is broken. It

often happens that one compressor crew must break out pavement for two or more jobs at the beginning of the day and the labor crews can do nothing until the pavement is broken. When the excavation is completed a plumber crew makes the repair. Unless timed perfectly either the labor crew or the plumber crew must wait. The proposed plan of organizing all of these operations under one foreman would greatly simplify scheduling and should result in less time lost by all crews.

d. Plumbing Shop: As of August 31, 1948, the staff assigned to the plumbing shop was as follows:

Positions	Number of Positions	Pay Rate Weekly	Pay Rate Annual	Annual Payroll Cost
Foreman plumber	1	$63.11	$3300	$ 3,300
Plumber	13	50.50	2626	34,138
Mechanic	1	50.50	2626	2,626
Repairer	2	50.50	2626	5,252
Sheet metal worker	1	50.50	2626	2,626
Coppersmith	1	50.50	2626	2,626
Plumber helper	1	47.50	2470	2,470
Chauffeur-laborer	3	47.50	2470	7,410
Totals	23			$ 60,448

The special work of a plumbing character in the Albany street district is organized under what is known as the plumbing shop. The 23 employes assigned to this show serve all of the day labor repair crews and contractors' crews on plumbing work. As a normal operation, city crews or contractor crews, depending on who is assigned the particular work order, open the trench and the plumbing shop sends a crew out to make the repairs as needed.

The force operates with five crews of two men each, one assigned to the contractor full time. One of the crews handles what are known as "no-force" (reduced pressure) complaints, testing for leaks, and attempting to relieve the stoppage if possible. Three of the five crews do similar work along with the repair gangs but also including installation of new services and general repairs.

One of the plumbers on the shop payroll has been loaned to the Dorchester District for almost a year. It is recommended that this employe be carried on the Dorchester district payroll. Two or three men are usually at work in the shop, making up connections and doing miscellaneous shop work. The shop maintains a seven-day service, having for one shift of each day at least one plumber and his chauffeur available for any emergency work.

During the summer a crew consisting of a "driller" and a plumber work steadily on relaying work. Plumbers are loaned occasionally to the other districts, particularly during vacation

periods. The mechanic carried on the payroll of this section is not used in this section but works as a storeskeeper. The sheet metal worker and the coppersmith devote most of their time to the maintenance of water pipe crossings on bridges.

Most of the smaller services of the City are of lead material, but more recently new services are being installed of copper as a result of experiments conducted some years ago. Repairs to lead services are made in lead unless the entire service is found to be defective, and in such cases it is replaced with copper.

A large part of the maintenance of service pipes appears to involve the connections with the curb cock and with the corporation cock at the main. At both of these locations there is a valve which can be shut off to discontinue the use of the service. Because of the age of the services, failures are probably more frequent than are normally expected. The corporation cocks frequently become encrusted on the inside of the main and thus reduce the water pressure furnished the premises. Relief is furnished in two ways. The plumbing shop attempts to blow the service out from the meter connection in the basement and, if this fails, the main is opened in the street and a plumbing crew "plunges" the service, removing the scale deposit.

The plumbing shop organization should be consolidated with other organization units doing maintenance work in the Albany street district as recommended elsewhere in this report. Plumbers would be assigned on a semi-permanent basis to the various foremen. The shop work could continue with one or two men as needed working under the supervisor proposed to head all maintenance work in the district.

The present plan for contracting a part of the excavation work does not appear to be a sound policy. Each day the contractors' forces are given a number of jobs without regard as to type or location. It would seem that the City could plan its work more efficiently if all of the jobs were handled by the day labor force. A saving could be made in the time required on checking measurements and processing payments to the contractor. The present plan of assigning a part of the work to the contractors serves to complicate further the organization. No one person is familiar with all of the various types of work being performed in the district.

e. Hydrants and Gates: As of August 31, 1948, the staff of the hydrants and gates section was as follows:

Position	Number of Positions	Pay Rate Weekly	Pay Rate Annual	Annual Payroll Cost
Inspector (foreman)	1	$57.38	$3000	$ 3,000
Repairer	7	50.50	2626	18,382
Hy. rep. and painter	1	50.50	2626	2,626
Chauffeur-mechanic	1	50.50	2626	2,626
Cement finisher	1	50.50	2626	2,626
Chauffeur-laborer	2	47.50	2470	4,940
Laborer	6	47.50	2314	13,884
Totals	19			$ 48,084

Within the large Albany street district the servicing of hydrants and gates is organized independently of other activities. There are 12,226 hydrants on the regular system and 505 on the high pressure fire system.

In the fall, before freezing weather sets in, crews are organized to inspect and service each hydrant in the district. The district is divided into 14 geographic areas for this purpose. Thereafter, during the winter months, hydrants are checked after each use. Between November 15 and March 15 the fire department is required to notify the water division of every hydrant that is opened. All hydrants are inspected again in the spring. Where major repairs are required the work is assigned to the regular hydrant repair crew working under the "repair gangs" unit.

Inspection of gates is very spotty and not according to any definite period of time.

During the winter months crews are assigned to marking the locations of gates and boxes on buildings and curbs so that they can be found in case of snow. It would seem that some method of permanent marking could be adopted to avoid this annual job. Most of the work in connection with hydrants and gates is done with one and two man crews.

In the summer months the employes in this section are assigned to "regulating" work in connection with paving operations. It is the duty of the employes to work with contractors to protect water appurtenances, such as seeing to it that valve boxes are raised to meet new grades. If properly instructed the regular paving inspectors could do this work in connection with paving inspection work. It should not be necessary for the water division to keep men on these jobs on a full time basis. It would probably be desirable for the division to assign one employe to work and consult with paving inspectors on water facilities.

The cement finisher is physically unable to do heavy work and normally is assigned to "regulating."

There are about 45 water fountains in the City of which 37 are iced including one at the Albany street yard. Icing is usually done from about July 1 to about September 8. Of the 37 iced fountains 18 are in the Albany street district. The City contracts for the furnishing of ice and the hydrant and gate section assigns two employes to check on ice deliveries for the 18 fountains.

The ice is purchased for $.35 a hundred pounds and 600 pounds are used for each of five days and 1200 pounds are used on Saturday (to include Sunday). For a period of one week each fountain is supplied with 4200 pounds of ice at a cost of $14.70. The labor cost for servicing 18 fountains is $50.50 and for one fountain it is $5.61 for a total cost of $20.31 a week or $88.01 a month for each of

the 18 fountains. Assuming that the cost of icing fountains in the other districts is approximately the same as in the Albany street district, the 37 fountains are costing the City about $3256 a month for iced water. The invoice for ice alone for 1948 amounted to $5320.

It would appear that such a deluxe service is not warranted. Also that even if it is decided to ice some of the fountains a different system of once-a-day inspection would eliminate the need for the two employes assigned to inspection on ice deliveries.

A rough breakdown of the work of this hydrants and gates section is as follows:

Type of Work	Percentage of Time
Regulating	12
Marking gates	15
Testing hydrants	50
Repairing hydrants	10
Painting hydrants	5
Miscellaneous	8
Total	100

Two of the employes classified as hydrant repairers do little if any work in this section and the positions should be eliminated or placed on the payroll of the section in which they work.

This organization unit should be consolidated with other units doing general maintenance work to provide for a more efficient plan of organization.

f. Emergency Crews: As of August 31, 1948, the staff assigned to the emergency crews organization in the Albany street district was as follows:

Position	Number of Positions	Pay Rate Weekly	Pay Rate Annual	Annual Payroll Cost
District Foreman	1	$57.38	$3000	$ 3,000
Emergency man	11	50.50	2626	28,886
Emergency man	1	47.50	2470	2,470
Emergency man-chauffeur	2	50.50	2626	5,252
Chauffeur-mechanic	1	50.50	2626	2,626
Mechanic	1	50.50	2626	2,626
Repairer	7	50.50	2626	18,382
Chauffeur-laborer	11	47.50	2470	27,170
Laborer	10	44.50	2314	23,140
Totals	45			$113,552

Emergency work for the Albany street district and for the City is organized on a 24 hour, 7 day a week basis. A special organization unit in the Albany street district services the entire City during off-shift periods. For all periods of day or night two crews of four employes each are available to meet emergencies. The total staffing for emergency work in this district is about as follows:

Shift		Number of Employes
12 a.m. to 8 a.m.	2 crews of 4 each	8
	1 clerk-watchman	1
8 a.m. to 4 p.m.	2 crews of 4 each	8
4 p.m. to 12 a.m.	2 crews of 4 each	8
	1 crew of 2 (off-and-on)	2
	1 clerk-watchman	1
Total number of employes working each day		28
Holidays, sick leave, and vacation relief		2
Total		30

On a seven day basis an average of 30 employes a day would require 42 employes on a 40 hour a week basis.

On the Saturday day shift a plumbing crew of two men, a repair crew, and an off-and-on crew are added to the two crews working for the emergency unit.

Emergency crews report to all third alarm fires to check pressures and assist the fire fighting forces generally on water matters. These crews make inspections of complaints of leakage but seldom do any digging or repair work. It is their duty to establish the causes of the leaks so that the proper crews can be assigned to make the repairs. If the leaks discovered are large or serious the crew shuts off the water until the repairs can be made.

A number of improvements can be made in the emergency service. First the number of emergency crews on duty during the regular day shift of which there are two of four men each, should be consolidated with the regular day forces. Regular off-and-on crews could make the investigations normally made by these crews. Saturday forces extend well beyond normal emergencies. It would be better if this work could be curtailed and Saturday staffed only for emergency work.

Also, as the emergency crews are not repair crews it would appear that a staffing of four employes for each crew is excessive. Two employes could do the investigating work and an arrangement be

provided for calling out regular repair crews when it is found that such repairs cannot be delayed. The present practice of keeping large crews on stand-by service is costly.

Also under this proposed plan the foreman supervising emergency crews would normally work the first evening shift when his supervision is most needed.

Although the Albany street district furnishes emergency service for the entire City the other districts also have employes assigned to emergency work. Emergency and stand-by crews for shifts other than the regular week-day 8 a.m. to 5 p.m. period are staffed approximately as follows:

	No. of Employes				
	Albany Street	W. Roxbury	Dorchester	Brighton	Total
Saturday					
12 m. - 8 a.m.	1	1	1	1	12
8 a.m.- 4 p.m.	17	3	3	2	25
4 p.m.-12 m.	11	1	1	1	14
Sunday					
12 m. - 8 a.m.	9	1	1	1	12
8 a.m.- 4 p.m.	10	1	2	1	14
4 p.m.-12 m.	11	1	1	1	14
Week-Days					
12 m. - 8 a.m.	9	1	1	1	12
4 p.m.-12 m.	11	1	1	1	14
Totals	87	10	11	9	117

Each of the four districts has someone in attendance at the district yard for the full 24 hour period seven days a week. The 12:00 midnight to 8:00 a.m. shift is staffed the same for the seven days with two emergency crews of four employes each at Albany street and one employe handling telephone complaints and watch service for each of the other three districts. The same is true for the 4 p.m. to midnight shift except that an extra two man crew is on at the Albany street district.

For the Saturday shift Albany street district uses 17 employes to man the two emergency crews, one off-and-on crew, a plumbing crew, a small repair crew, and a compressor crew. West Roxbury and Dorchester each use an off-and-on crew of two employes in addition to the office clerk-watchman. Brighton uses only two employes for this Saturday shift one acting as a one man off-and-on crew.

The total staffing for emergency and stand by work for the seven day period, but not including the regular week-day shift is therefore approximately as follows:

	Number of Employes	Man Days
12 m. to 8 a.m., 7 days a week	12	84
8 a.m. to 4 p.m., Saturday	25	25
8 a.m. to 4 p.m., Sunday	14	14
4 p.m. to 12 m., 7 days a week	14	98
Total number man days a week		221
Total number of employes (5 day week)		44

It, therefore, costs the City the salaries of 44 employes (over $100,000 a year) to maintain the emergency and stand-by service not including the emergency crews used at Albany street during the regular day shifts. A reduction in size of crews from four to two men for Albany street should be made which would amount to 11 positions, not considering the regular day which should be consolidated with other repair crews. It would also seem that there is little need for maintaining a telephone complaint service at each of the districts. Actually no work is done by the districts and if an emergency occurs that needs immediate attention it is referred to the Albany street district. It is recommended that these district offices be closed and that the telephones be connected with the Albany street district so that one office could handle all calls. This change would make possible a better dispatching of crews and save eight positions. It would probably be desirable to keep the small force on in each of the districts for one Saturday shift.

These two changes would make possible the elimination of 19 positions with annual savings in salaries of about $50,000.

g. Albany Street Yard: As of August 31, 1948, the staff assigned to work in the Albany yard was as follows:

Position & Unit	Number of Positions	Pay Rate Weekly	Pay Rate Annual	Annual Payroll Cost
Yard - Vehicles				
Working foreman	1	$51.64	$2700	$ 2,700
Chauffeur-auto-mechanic	1	50.50	2626	2,626
Chauffeur-laborer	8	47.50	2470	19,760
Sub-totals	10			$25,086
General Maintenance				
Yardmaster	1	57.38	3000	$ 3,000
Hoisting der. operator	1	54.92	2856	2,856
Repairer	2	50.50	2626	5,252
Carpenter	1	50.50	2626	2,626
Emergency man	1	50.50	2626	2,626
Laborer	2	44.50	2314	4,628
Sub-totals	8			$20,988
Carpentry				
Master carpenter	1	53.55	2800	$ 2,800
Carpenter	1	50.50	2626	2,626
Sub-totals	2			$ 5,426
Totals	20			$51,500

The unit called "yard-vehicles" is a chauffeur pool for the division. One chauffeur drives for the division engineer and another drives for the superintendent. One chauffeur works full time for the hydrants and gates unit and should be carried on that payroll. Two chauffeurs drive derrick trucks, three drive dump trucks, and one is carried for relief in case of sickness, and vacations. These chauffeurs haul pipe, tool boxes, and other supplies to the gangs as needed. They also do minor service on the equipment such as changing tires and batteries.

The working foreman in charge of the unit is responsible for the condition of his equipment and assignment of men.

The yardmaster has a staff of seven employes working for him doing miscellaneous yard work such as loading materials, cutting pipe to measurements, general cleaning, and checking equipment in and out of the yard.

The carpenters' principal job is making barricades, cutting wood for shoring, and general repair work on buildings of the water division. It was observed that heavy stock was being made into

"horses" which are used as warning barricades. The resulting barricades used much more material than was needed and the weight was excessive for ease in handling. More attention should be given to the work of this unit and designs for all work of this type should be approved by the engineers, and the work authorized by the superintendent. One position of carpenter should be eliminated.

h. Charlestown Sub-yard: The Charlestown sub-yard is a small unit attached to the Albany street district and is staffed as follows:

Position	Number of Positions	Pay Rate Weekly	Pay Rate Annual	Annual Payroll Cost
Plumber	1	$50.50	$2626	$ 2,626
Chauffeur-laborer	1	47.50	2470	2,470
Laborer	6	44.50	2314	13,884
Totals	8			$ 18,980

These employes are assigned full time to the Charlestown area to avoid the travel time that would be lost by crews traveling from Albany street. These crews do all kinds of maintenance work except repairs to large mains. They do off-and-on service, repair service leaks, inspect and test hydrants, handle no-pressure complaints, and change meters. The present arrangement seems to be desirable from an organization point of view and the staffing appears reasonable.

11. Dorchester District

As of August 31, 1948, the staff of the Dorchester district was approximately as follows:

Position	Number of Positions	Pay Rate Weekly	Pay Rate Annual	Annual Payroll Cost
District foreman	1	$63.11	$3300	$ 3,300
Yardman repairer	1	49.73	2600	2,600
Pipe layer-repairer-chauffeur	12	50.50	2626	31,512
Chauffeur-laborer	2	47.50	2470	4,940
Laborer	5	44.50	2314	11,570
Totals	21			$ 53,922

The equipment of this district consists of four trucks, a compressor, and a Ford sedan for the foreman.

In general the crews in the Dorchester district handle the same maintenance work as do the specialized crews in the Albany street district. The district force of 21 employes maintains hydrants, gates, mains, and services, and installs new services. The district

crews also exchange meters on complaints. The work of the district is organized about as follows:

Number Employes	
1	District foreman supervises all work.
5	Crew of five repair mains and hydrants.
2	Crew of two do plumbing work with contractor labor crews.
2	Crew of two follow complaints on "no-force."
1	Crew of one does off-and-on work.
1	Clerk-yardman does general office work.
1	Clerk and janitor.
1	Chauffeur for foreman and fills in on off-and-on work.
4	Watch service - handles complaints.
1	Working foreman - pipe layer.
1	Chauffeur and compressor operator.
1	On hydrant inspection and regulating.
21	Total

In addition to the 21 employes on the payroll of the district, a plumber from the plumbing shop has been loaned to the district for eight or nine months.

If an emergency occurs during off-shift hours that requires immediate attention, the complaint is referred by the clerk to the Albany street district emergency crews. It is reported that such instances are very unusual.

Although only one man is assigned full time to hydrant work, most of the crews in the district do hydrant inspection and testing in the fall. In this district the fire department does a certain amount of testing but does not concern itself with greasing and other servicing of hydrants. It is reported that each hydrant is inspected at least once every two years. All hydrants should be inspected at least once a year in the fall before freezing temperatures occur.

It was observed that the employes in this district are capable of doing a wide variety of jobs, thus making it easier to staff individual jobs. The district appears to be caught up with leaks, having a backlog of only three at the time of making this study. However, there are numerous complaints of "no-force" and the crews service four or five of such complaints a day.

A large crew of five employes does investigation work of emergencies but unlike the Albany street emergency crews, this crew is also a work crew and makes the repairs needed. It is also noted that the district uses a one man crew for off-and-on work.

It is reported that this district also has many dead services that have not been plugged at the main but no program is set up for such work.

In contrast with the Albany street district the Dorchester crews open exploration holes at the building line without a deposit from the owner. If the leak is determined to be the responsibility of the owner the hole is left open so that the owner can make the repair. A city-wide policy should be established on deposits, as recommended elsewhere in this report.

The superintendent with offices at Albany street district yard exercises very little supervision over the work of the Dorchester district. The position of chauffeur, used by the foreman, is not needed.

The employes assigned to watch service and handling complaints have "repairer" classification and pay rate. The skilled classification is used for this work so that complaints can be handled competently. By transferring these calls to the Albany street district, the division is assured of careful handling of complaints by employes who are familiar with the water distribution system.

The Dorchester district is staffed with a clerk and one off-and-on crew of two employes for the Saturday day shift. A one-man off-and-on crew in addition to the clerk also works out of this district on Sunday.

The practice on backfilling in this district also varies from the Albany street district in that both contractor and City forces puddle the filled trenches to obtain settlement.

12. West Roxbury District

As of August 31, 1948 the staff assigned to this district was approximately as follows:

Positions	Number of Positions	Pay Rate Weekly	Pay Rate Annual	Annual Payroll Cost
District foreman	1	$63.11	$3300	$ 3,300
Clerk	1	57.38	3000	3,000
Inspector	1	57.38	3000	3,000
Met. Rep. Installer	1	53.55	2800	2,800
Yardman Repairer	1	49.73	2600	2,600
Pipe Layer-Repairer-Laborer	9	50.50	2626	23,634
Repairer	1	47.50	2470	2,470
Chauffeur-laborer	4	47.50	2470	9,880
Laborer	6	44.50	2314	13,884
Totals	25			$ 64,568

This district has the use of one dump truck, a pick-up used by the plumber crew on contractor work, a pick-up on miscellaneous complaints, a pick-up used by the foreman, and a portable compressor mounted on a jeep - five units of motor equipment.

The work in the West Roxbury district is similar to the work reported on for the Dorchester district. In this district, however, practically everyone investigates leaks which permits more economical staffing. It was not known definitely if the Albany street district serviced the large gates (16" or larger) but it was thought that this was not a responsibility of the West Roxbury district. This situation further supports the recommendation made elsewhere in this report that a manual be prepared outlining specifically the duties of the various districts.

The West Roxbury district services about 75 percent of all hydrants each year and services each hydrant at least once every two years. Hydrants should be serviced at least once annually.

A chauffeur on the payroll of this district is assigned to one of the district engineers. It is recommended that this position be eliminated.

The district maintains a continuous 24 hour watch and telephone complaint service but calls upon the Albany street district for help when a field crew is needed. It was reported that not more than six calls a year are made to the Albany street district for help. Although the sewer and paving divisions use the same yard all of the watch service is handled by the water division.

The superintendent exercises very little supervision over the work of this district.

13. Brighton District

As of August 31, 1948 the staff of this district was approximately as follows:

Position	Number of Positions	Pay Rate Weekly	Pay Rate Annual	Annual Payroll Cost
District foreman	1	$61.20	$3200	$ 3,200
Chauffeur mechanic	1	50.50	2626	2,626
Pipe layer-repairer	1	50.50	2626	2,626
Plumber	1	50.50	2626	2,626
Chauffeur-laborer	3	47.50	2470	7,410
Laborer	9	44.50	2314	20,826
Totals	16			$ 39,314

The Brighton district crews function in a manner similar to the Dorchester district crews with very little specialization. There are four trucks assigned to the district - two half-ton pick-ups, a one ton utility truck, and a dump truck. A compressor is mounted on a trailer and is usually transported by the one-ton truck.

The largest crew in this district consists of three employes who work somewhat differently from other districts. The chauffeur, plumber, and a helper service the contractor's forces but also schedule work on no-force complaints and change meters.

The three watchmen serve the district yard during off shift periods. A meter-reader clerk who is on the City Hall payroll is loaned on a permanent basis to this district.

Hydrants are serviced once a year as in the Albany street district.

Deposits are taken on "in doubt" exploration holes that are dug on public property adjacent to the building wall.

It would appear that the superintendent has little to do with the operation of this district except that major breaks are reported to him.

14. Miscellaneous Policies and Procedures

a. Contract Excavation Work: The City has adopted an unusual policy in handling miscellaneous earth excavation work. Annually contracts are awarded for each of the districts for excavation by the cubic yard and linear foot of trench and for other miscellaneous work. The prices quoted for this work vary considerably among the districts as revealed in the following tabulation:

	Brighton	W. Roxbury	Albany St.	Dorchester
Earth Excavation				
Estimated W. yds.	2000	4000	10,000	6000
Price per cu. yd.	$3.00	$3.75	$3.60	$3.50
Lin. ft. of service pipe	800	2500	2000	1000
Price per lin. ft.	$5.25	$3.00	$3.00	$3.00
Cold Patch Repair				
Estimated Quantity	500	2500	4000	2500
Price per sq. yd.	$1.00	$1.00	$1.50	$1.50

A trench in the Albany street district is normally figured at four feet wide by six feet deep making 24 cubic feet of excavation for each linear foot of pipe laid. The contract price a cubic yard

($3.60) is not greatly different than the linear foot price ($3.00). In the Brighton district, however, the prices vary so that the cubic yard basis is much less expensive.

However, it appears that the policy is to pay the contractor on a cubic yard basis for all maintenance work, even though an entire service is relaid, and to use the linear price per foot only for new services.

Wide variations are also found to exist in the methods of measuring the excavation on which to make payments. In each case the contractor submits his bill for his work by showing the width, depth, and length of excavation. An analysis of the bills for the month of August reveals that in the Albany street and Dorchester districts trenches are always considered to be four feet wide and six feet deep, whereas in the West Roxbury and Brighton districts trenches are only three feet wide and six feet deep. In the Albany street district the length of the trench is always two feet or more longer than the pavement opening, whereas in West Roxbury and Brighton the trench length is usually the same as the pavement cut length.

In all cases it would seem that the City is paying for more quantity of excavation than is actually being excavated. There is seldom need for a trench four feet wide and generally three feet is more than is needed. A two foot trench at the bottom is often adequate and some of the trenches visably appear to be no wider than two feet. Seldom is the service or repair a full six feet deep for its entire length. Some appear to be no deeper than four feet. It is, therefore, apparent that the excavation measurements are not only inconsistent but are considerably larger than openings needed and larger than the actual openings made - probably as much as twice the total actual volume in some instances. Further than this, it was found that the policy of checking contractors' measurements varies among the districts. In one district the foreman makes all measurements, in another district either the foreman or the plumber makes the measurements, and in another it is reported that the plumbing crew takes the measurements; but in the largest district with headquarters at Albany street it appears that no one was assigned to making these measurements, the contractors' measurements being accepted as a basis for payment. (As of November 1948 it was reported that all excavations were being measured by the Water Division.)

A number of improvements can be made in this contract arrangement for excavation. Generally, it would seem that all excavations over a minimum length of six feet should be paid for on a linear foot basis and that the City should specify the width of trench required. Most of the work could then be paid for on a linear foot basis, and the depth and width of trench would not be considered in determining charges for this excavation work. For the few instances when trenches over six feet are required an additional charge should be made for each foot of additional depth. For small irregular or exploratory types of excavation work the City should establish a procedure whereby the plumber would make the measurements and forward

them through his foreman to the district engineer. These measurements, rather than those made by the contractor, should become the basis for paying the contractor for the work performed.

b. Deposits for Private Work: It is a policy of the City to make repairs to private services up to the property line, and any repairs inside the property line become a responsibility of the owner. There are occasions when the source of a leak cannot be determined in advance of the excavation. If it is not definitely assured that the leak occurs within the foundation wall or on private property, the City makes the excavation and if determined to be on private property the repair is made by a plumber hired by the owner. The practice on making this excavation varies among the districts. Both Albany street and Brighton districts require a deposit in advance of any excavation by the City wherever it appears that the trouble may be a responsibility of the owner. However, West Roxbury and Dorchester do not require deposits for similar excavation work. In Dorchester the City makes the excavation and, if the leak is discovered to be on private property, no charge is made if the owner immediately sends a plumber to make the repairs. It is recommended that a definite policy be established for handling excavations where responsibility may or may not be that of the owner. The inconsistencies among the districts show the need for more supervision and coordination at a higher level and establishment of general policies that should apply to all areas of the City.

c. Backfilling Trenches: Trenches are backfilled by tamping and by puddling, the practice varying among the districts. A definite policy should be established and described in written form for the guidance of district crews.

When the backfill is completed it is the practice of the division to require that each repair crew make a cold patch repair. Similarly contractors make temporary cold patch repairs when they complete their work. It would be better if one small crew of the water division was made responsible for all pavement repair work, or better, the repair should be immediately assigned to the paving division so that all pavement repairs could be coordinated for more economical maintenance. The agency that is ultimately responsible for the maintenance of the excavated area is in the best position to make the repair.

d. Hydrant and Gate Inspection: The practice on hydrant and gate inspection varies somewhat among the districts. In the case of the larger gates it would appear that a definite policy on responsibility is not well established. The maintenance of these appurtenances of the water system is very important and should be conducted according to well established written policy. Every hydrant in the City should be serviced at least once each year and after each use during the winter months. A definite route system should be laid out in each district and a schedule of inspection order established. The servicing of gates should be geared to the needs as determined by experience with the Boston design of gate.

e. Chauffeurs Assigned to Supervisors: It is common practice for supervisors to have chauffeurs assigned to them on a full time basis. In some instances, it is reported that the chauffeurs have duties incidental to the work of the supervisor but this is not generally true. In the engineering unit, for example, one engineer uses a chauffeur and the other uses a rodman to do chauffeur work incidental to the engineering. The second mentioned practice is preferred where a rodman is needed on the job; otherwise the engineer should drive the automobile.

As of August 1948 chauffeurs were used in connection with supervisory positions as follows:

Position	Number of Positions	Number of Chauffeurs
Division engineer	1	1
Superintendent	1	1
District engineers	2	1
Foreman of district	3	3
Inspector (hydrants and gates)	1	1
Inspector (outside employes)	1	1
Total		8

The chauffeur assigned to the division engineer is not busy much of the day but he is probably needed for those special occasions. It would seem that the other seven positions should be eliminated. The remaining chauffeur could divide his time between the division engineer and the superintendent, as needed.

f. Manual of Standard Practices: It is practically impossible to obtain any degree of uniformity of practices within an organization composed of districts unless all common operations are described in written form. Similarly an accurate understanding of the duties of supervisory positions can only be acquired through written statements of duties. Otherwise there will be overlapping and duplication of work and also omission.

A manual of standard practices is needed by the division of water. The preparation of such a manual would bring to light present inconsistencies and result in general improvement. Practices in requiring deposits for private work, the sealing of meters and meter connections, the measuring of excavations for contract payment, the backfilling of trenches, and the inspection of hydrants and gates are cited as examples of work that are not performed in a consistent manner throughout the City. Such inconsistencies may exist for long periods of time without being discovered unless a manual is prepared.

Similarly, each supervisor in the water division should have a complete understanding of his duties and responsibilities. He should know the scope of his work in relation to other supervisors.

There should never be any question in his mind, for example, as to who is responsible for the maintenance of gates or the taking of measurements for contract work. In fact, even the method of taking the measurements should be fully described to show the limits of accuracy, top and bottom widths of trench, and the allowance for tunneling. Specific instructions should be given as to the method of payment, that is, if it is to be on the cubic yard basis or by the linear foot, as determined by the nature of the excavation.

15. Personnel Practices

It is freely admitted by employes of the water division that City employes produce only about one half as much work as do contractor employes. The comparison is made between the labor forces of the contractor and the labor forces of the City doing similar work. The general attitude of City supervisors seems to be that there is not much that can be done about it and this serves to justify, to the satisfaction of the water division, the employment of contractors to do labor work.

This situation appears to prevail in the other classes of employes although there is no definite yardstick for making the comparison. Probably the lack of an aggressive attitude and interest in production by individual employes is contributing more to the inefficiencies of the division than any other one condition.

The low production of employes is probably made worse because of a morale condition that is certain to exist where like pay is not given for like work and where the class title of an employe may bear no relation to his duties. Laborers are sometimes doing skilled work and skilled classes are often doing only laborer work. The differences between rates of pay in private industry and the City undoubtably contribute to lowering morale of City employes. A complete overhauling of the classification and compensation system is needed.

At the time of this study payments to employes were made in cash. At least one foreman made personal deliveries of pay envelopes to each of his employes. It was reported that the plan was being changed and hereafter all employes would be required to return to their district yards to pick up their weekly pay envelopes. This is a very costly system as it will result in all employes losing an hour or more of work once each week. More will be said on payroll methods in another report in this series.

The working hours of the various units of the division are not always adhered to. It was noted that the employes in one unit quit work about one hour before the end of the work day. It was reported that various attempts had been made to correct the situation but such results as were obtained were of short duration. It is recommended that supervision be strengthened to prevent abuses of this

type and also that time clocks be considered for all operations where employes meet at one location.

It is common practice to loan employes from one unit to another over a period of months without making a corresponding change in payrolls. All employes should be on the payrolls of their supervisors.

The water division recognizes twelve holidays as follows:

(1) New Year's Day
(2) Washington's Birthday
(3) Evacuation Day
(4) Patriots' Day
(5) Memorial Day
(6) Bunker Hill Day
(7) Independence Day
(8) Labor Day
(9) Columbus Day
(10) Armistice Day
(11) Thanksgiving Day
(12) Christmas

16. Revenues and Expenditures

The revenues of the water division have exceeded the expenditures of the division each year since 1937 when there was a deficit of $54,399.27. The principal source of revenue is, of course, the charges for water consumption. No charge is made and no accurate account is kept of the water used by City departments or schools or for fire fighting and road flushing. In 1947, approximately 68 percent of the water purchased from the Metropolitan Water Board was charged back to customers. The percentage accounted for is low and could be increased if meters were installed and repaired and a program of water leakage control initiated as recommended elsewhere in this report.

The amounts billed and collected over the past ten year period are reported as follows:

Year	Water Billed to Consumers	Collections Current Year	Collections Previous Year	Total Receipts (1)
1938	$4,718,916	$3,183,904	$1,867,324	$5,155,051
1939	4,570,436	3,489,006	1,608,982	5,167,428
1940	4,653,951	3,592,507	1,207,270	4,781,639
1941	4,892,269	3,856,694	1,020,579	4,994,452
1942	5,229,393	4,226,226	993,048	5,417,184
1943	5,414,575	4,352,417	660,350	5,357,155
1944	5,655,498	4,455,844	756,424	5,527,886
1945	5,757,423	4,562,935	854,823	5,719,125
1946	5,195,610	4,467,603	897,013	5,692,295
1947	4,846,113	4,076,645	571,372	4,903,277

The decrease in billings and revenues shown in 1946 and 1947 was due to a reduction of 20 percent in the rates charged to consumers which became effective on July 1, 1946. This rate reduction followed a reduction in rates charged to the City by the Metropolitan Water Board effective January 1, 1946. The rate fixed in 1946 and now effective is $40.00 a million gallons of water purchased. Previously the charge had been fixed as a proportion of the costs of the Board and was based on a combination of valuation and consumption percentages.

During 1947, the rates at which consumers were charged for water were as follows:

Rate per 1000 cu. ft.	Consumption in Billing Period	Total Cu. Ft. Consumed by Customers
$1.50 or more	Minimum - $8.00 a year	62,293,200
1.50	0 - 20,000 cu. ft.	1,568,550,300
1.40	20,000 - 40,000 " "	256,835,400
1.25	40,000 -100,000 " "	1,044,699,400
.84	100,000 or over " "	682,997,300
	Total consumption charged to customers	3,677,699,300

At the rate of $40.00 a million gallons, the Metropolitan assessment of $1,619,881.32 shows a water delivery to the City of Boston of 40,497 million gallons, or 5,414,000,000 cubic feet for the year 1947.

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(1) Includes receipts for new services and other work.

Expenditures made from water funds as shown in the annual reports of the City auditor are as follows:

Year	Metropolitan Assessment	Maintenance Expenditure	Auditing & Collecting Departments	Debt Service	Surplus Revenue
1938	$3,282,930	$ 804,170	$240,922	$74,146	$ 654,998
1939	3,184,760	1,051,505	102,337	71,006	757,454
1940	3,110,209	1,081,049	101,069	69,462	418,454
1941	3,060,279	1,058,978	98,912	63,544	639,584
1942	2,906,979	1,024,086	99,572	52,312	1,305,742
1943	3,079,009	993,700	102,915	54,456	1,110,823
1944	2,974,084	1,041,898	108,223	23,213	1,350,224
1945	2,908,331	1,166,730	120,240	49,969	1,473,055
1946	1,615,873	1,413,167	139,844	47,666	2,605,308
1947	1,619,881	1,613,358	163,601	44,800	1,502,883

Each year all surplus revenues are turned over to the general funds of the City and it is reported that such revenues are used for debt reduction purposes as required by statute.

The decrease in the payment for collecting and auditing in 1939 is due to the transfer of the billing function from the collector's office to the water division where it has since remained.

The maintenance expenditure for the water division by budgetary classes in 1947 and the amounts budgeted for 1948 are as follows:

Item	1947 Expenditure	1948 Budget
Personal services	$ 990,152	$1,000,870
Contractual services	320,604	353,836
Equipment	98,689	90,360
Supplies	38,312	31,665
Materials	119,228	185,100
Special Items	46,372	31,500
Totals	$1,613,357	$1,693,331

As of December 31, 1947, there were serial bonds outstanding in the amount of $262,000 that were issued for water main reconstruction and replacement and secured by water revenues. This debt is being reduced by annual payments of $36,000 and the debt will be fully retired by 1955.

17. Summary of Savings

The adoption of the recommendations made in this report should result in annual payroll savings of $172,000. These savings are summarized as follows:

Unit	Number of Positions Eliminated	Annual Payroll Saving
Office of the division engineer	2	$ 6,300
Office of the executive secretary	2	4,700
Chief clerk's office and miscellaneous employes	6	10,200
Meter reading section	8	19,600
Billing section	1	1,700
Albany district-organization	24	60,000
Emergency crews	19	50,000
Albany street yards	1	2,600
Chauffeurs assigned to supervisors	7	17,300
Totals	70	$172,400

The water division could save the salaries of 70 employes without any sacrifice in work accomplishment. However, it is recommended that some of these savings be used for establishing a program of plugging abandoned services at the mains, strengthening the engineering section, and for improving and expanding operations of the meter shop.

An average staff of 15 or 20 employes should be adequate for the program of plugging services. Probably two employes should be added to the engineering section and about six employes should be added for repairing and replacing meters.

The increases in staff recommended for engineering and for plugging abandoned services should result in reduced underground leakage of water and produce a saving in assessments made by the Metropolitan Water Board of $100,000 a year or more. The improvement of the meter shop as recommended should result in an increase in revenue of as much as $500,000 a year.

In summary, by adopting the recommendations contained in this report the City can make an immediate saving in payrolls of about $100,000 a year, improve the standard of maintenance of the distribution system for better service, reduce the annual assessment charges made by the Metropolitan Water Board by $100,000 or more, and increase revenues by as much as $500,000 a year.

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